

4. The method of claim 2, wherein said layer of metal nitride has a thickness in the range of about 10 Å to about 1000 Å.

5. The method of claim 2, wherein said layer of metal nitride has a thickness in the range of about 50 Å to about 350 Å.

6. The method of claim 2, wherein said layer of metal nitride has a thickness of about 100 Å.

7. The method of claim 2, wherein said metal nitride is formed using a nitrogen rich radiofrequency (rf) plasma.

8. The method of claim 7, wherein radiofrequency plasma is formed using hydrogen and nitrogen gases having a ratio in the range of about 0.1:1 to about 4:1.

9. The method of claim 7, wherein radiofrequency plasma is formed using hydrogen and nitrogen gases having a ratio in the range of about 0.5:1 to about 2:1.

10. The method of claim 7, wherein radiofrequency plasma is formed using hydrogen and nitrogen gases having a ratio of about 3:2.

11. The method of claim 7, wherein the rf plasma power is in the range of about 100 Watts per 8 inch wafer to about 1000 Watts per 8 inch diameter wafer.

12. The method of claim 7, wherein the rf plasma power is in the range of about 400 Watts per 8 inch wafer to about 800 Watts per 8 inch diameter wafer.

13. The method of claim 5, wherein the rf plasma power is about 750 Watts per 8 inch wafer.

14. The method of claim 7, wherein the rf plasma is generated in the presence of a noble gas.

14. (Amended) The method of claim 14, wherein said noble gas is selected from the group consisting of helium, neon, argon, krypton and xenon.

Al
16. The method of claim 7, wherein the pressure in the plasma chamber is in the range of about 100 milliTorr to about 50 Torr.

17. The method of claim 7, wherein the pressure in the plasma chamber is in the range of about 1 Torr to about 10 Torr.

18. The method of claim 7, wherein the pressure in the plasma chamber is about 4 Torr.

19. The method of claim 1, wherein the step of depositing a layer of doped dielectric material is carried out at a deposition temperature in the range of about 200° C to about 450° C.

20. The method of claim 1, wherein said doped dielectric layer is selected from the group consisting of fluorine doped silicate glass (FSG), phosphorous doped silicate glass (PSG), boron doped silicate glass (BSG), and boron phosphorous doped silicate glass (BPSG).

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21. The method of claim 2, wherein said metal nitride layer comprises a metal selected from the group consisting of aluminum, ~~tantalum~~ and titanium.

22. A method for reducing diffusion of dopant ions from a dielectric layer into a metal layer, comprising:

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22. (a) depositing on said metal layer, a nitrogen rich metal nitride layer; and
(b) depositing a layer of doped dielectric material on said nitrogen rich metal nitride layer.

23. (Amended) The method of claim 22, wherein said metal nitride layer is made using a radiofrequency (rf) method using at least one variable selected from (a) a hydrogen:nitrogen ratio in the range of about 0.1:1 to about 4:1, (b) an rf power in the range of about 100 Watts per 8 inch wafer to about 1000 Watts per 8 inch diameter wafer, (c) a pressure in the plasma chamber in the range of about 100 milliTorr to about 50 Torr, and (d) a deposition temperature in the range of about 200° C to about 450° C.

24. (Amended) The method of claim 22, wherein the metal nitride is selected from the group consisting of aluminum nitride, ~~titanium~~ nitride, and tantalum nitride.

25. (Amended) A method for reducing diffusion of dopant ions from a dielectric layer into a metal layer, comprising:

- A1*
- (a) providing a substrate;
 - (b) depositing over said substrate, a metal layer from the group consisting of aluminum, titanium, tantalum and aluminum/tantalum;
 - (c) forming a metal nitride using a nitrogen rich plasma using at least one variable selected from the group consisting of:
 - (i) a hydrogen:nitrogen ratio in the range of about 0.1:1 to about 4:1;
 - (ii) an rf power in the range of about 100 Watts per 8 inch wafer to about 1000 Watts per 8 inch diameter wafer;
 - (iii) a pressure in the plasma chamber in the range of about 100 milliTorr to about 50 Torr; and
 - (iv) a deposition temperature in the range of about 200° C to about 450° C; and
 - (d) depositing on said metal nitride layer, a layer of doped dielectric material selected from the group consisting of fluorine doped silicate glass (FSG), phosphorous doped silicate glass (PSG), boron doped silicate glass (BSG), and boron phosphorous doped silicate glass (BPSG).

26 - 28. Withdrawn.

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A2 29. The method of claim 2, wherein said ~~barrier~~ layer is formed using electromagnetic radiation.

As amended

30. The method of claim 2, wherein said barrier layer is formed using nitrogen ion implantation.

31 - 47. Withdrawn.